Amendments to the Drawings

The attached sheet of drawings includes changes to Figure 5. This sheet, which includes Figures 5 and 7, replaces the original sheet including Figures 5 and 7. In Figure 5 a "PRIOR ART" legend has been added.

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

Remarks/Arguments

Claims 1 – 5, 7, 9 – 12, 14 and 15 are currently pending in this application. Claims 11 and 12 have been withdrawn and Claims 1 – 5, 7, 9, 10, 14 and 15 currently stand rejected.

In Section 4 of the Office Action Fig. 5 was objected to for not having a prior art legend. The enclosed amendment to Fig. 5 should cure that defect. Accordingly, it is respectfully requested that the objection to Fig. 5 be withdrawn.

In Sections 5, 6 and 7 of the Office Action Claims 1 – 5, 7, 9, 10, 14 and 15 are objected to under 35 U.S.C. §112, first paragraph. The Examiner objected to the amendment to the independent claims made in the previous response that added the phrase "continuously contact" to the limitation that the dimples/springs in the auxiliary grid and main support grid continuously contact the fuel element. In support of this objection the Examiner asserted that the original specification discloses only that the dimples and springs "contact" the fuel element. In this regard, for example in Section 5 of the Office Action, the Examiner stated:

> There could be at least two possible species of so called "contact", e.g., continuous contact and non-continuous contact. The specific species of "continuous contact" between said elements has neither been referred to, taught, nor disclosed in the original specification.

In section 7 of the Office Action the Examiner stated that:

> Note that the term "continuously contact" can be interpreted in different ways, e.g., a) area-wise continuous contact, wherein the entire surface area of a dimple/spring contacts a fuel element without any gaps between the two surfaces, such total area contact occurring either at all times or at certain times, e.g., during plant operation; b) time-wise continuous contact, wherein there is periodic contact/non-contact between a portion of a dimple/spring with a fuel element, i.e. there is intermittent but still continuous contact, e.g., during plant operation; c) time-wise continuous contact, wherein a portion of the area of a dimple/spring is in contact with a fuel element at all times, e.g., during plant operation.

At the bottom of page 8 starting at line 31 Applicants set forth the problem of baffle jetting causing fretting in the fuel rods around the outer periphery of the core. On page 10 starting with the sentence that starts on line 20 Applicants describe a conventional main support grid 46 and mention that:

> The spring and dimple pattern shown in Fig. 5 is for a conventional main support grid 46 with the spring portion identified by reference character 86 and the dimples represented by reference character 88. The upper and lower stamped segments 88 bulge out in one direction and form dimples for supporting the fuel elements against juxtaposed diagonal springs 86 which protrude from the opposite cell wall . . . for pressuring the fuel element against dimples 88.

In discussing the auxiliary grids of this invention the specification goes on at page 11, starting at line 5 to state:

> From Fig. 6, it can be seen that the dimples and/or springs 88, 86 are coplanar and contact fuel rods on multiple sides to provide additional rod support. In this embodiment, the springs are vertical rather than on a diagonal. As stated previously for the main support grids, the location of the vibration-resistant auxiliary grids are fixed relative to the fuel assembly at the thimble locations . . . The inner straps 76 and 78 on the auxiliary grids provide for a larger contact area between the dimple/springs and the fuel elements than are provided by the corresponding contact areas on the main support grids.

Continuing on page 12, line 4 the specification goes on to state:

> This latter feature plus the location of the auxiliary anti-vibration support grids 68 in the fuel assembly 16 eliminate the fuel rod instability that leads to grid-to-rod fretting in high crossflow plants with pressure relief holes. In most other respects, the auxiliary support grid is constructed in the same manner noted for the main support grids.

Thus the purpose of the auxiliary support grids are clearly stated to add support to the fuel rods to prevent them from vibrating and causing fretting. It is well known in the art that the main support grids are provided to bias the fuel rods against juxtaposed dimples or springs to support

the fuel rods against lateral as well as axial movement. The auxiliary grids are clearly provided to re-enforce that support and cannot do that without continuous contact and pressure on the fuel rods in the lateral direction. The term has been added to distinguish over specialty grids of some of the references which were not provided for support, but for other reasons as will be pointed out hereafter. Read in the context of the specification the term continuous support can not rightfully be considered ambiguous or new matter. Accordingly, it is respectfully requested that the objection raised in Sections 5, 6 and 7 of the Office Action be reconsidered and withdrawn.

As suggested in the Decision on Petition Under 37 C.F.R. 1.181 mailed February 1, 2006 the amendment to the first full paragraph spanning pages 11 and 12 is resubmitted in this response. Entry is respectfully requested.

In Section 8 of the Office Action Claim 15 is rejected under 35 U.S.C. §102 (b) as being anticipated by Thomazet et al. (U.S. 4,804,516). In support of this rejection the Examiner asserted that the plurality of main support grids reads on grids 6 – 9 and 16 and that the "at least one auxiliary grid" reads on anyone of grids 10, 11 and 12. In that regard the Examiner noted that grid 11, for example, is "sandwiched" (i.e., enclosed) between grid 9 and 16, at an elevation in the mid third region of the fuel element. However, the Examiner goes on to note that a plurality of the main support grids (e.g., grids 6 – 9) are evenly spaced and in tandem.

Applicants' Claim 15 calls for a plurality of substantially evenly spaced main support grids arranged in tandem and at least one auxiliary grid positioned in tandem with and sandwiched between the main support grids. The only main support grids called for in the claim having antecedent basis for the term "the" are the plurality of substantially evenly spaced main support grids called for in the claim. If that is the case, then grid 16 of Thomazet has to be considered either part of that plurality of main support grids or not part of that plurality of main support grids. It can not be part of the plurality for one purpose, i.e., to anticipate the auxiliary grid sandwiched between two main support grids and not for another, i.e., to anticipate evenly spaced main support grids. If it is part of the plurality of main support grids for the purpose of meeting the limitation that the auxiliary grid 11 is sandwich between two main support grids 9 and 16 then it can not be consider as meeting the limitation that the main support grids are evenly spaced, because grid 16 certainly has different spacing than grids 6 - 9.

As stated in Applicants' previous responses to the application of Thomazet et al. to Applicants' claims, Applicants disagree that the mere fact that the intermediate grids have double

bosses while the peripheral grid has single bosses contacts does not mean that the contact area of the double bosses is greater than that of the single bosses, since there is no mention within the application of there relative size and Applicants have previously cited support for why it is improper to rely upon the relative dimensions shown in the drawings, which were never intended to be drawn to scale. However, if the Examiner wants to rely upon the drawings he should not ignore Applicants limitation that the full extent of the axial length of the walls of the auxiliary grid support cells is shorter than the corresponding walls of the main support grid cells. Relying upon the drawings of Thomazet et al. in which Figs. 5 and 6 represent what the Examiner is calling the auxiliary grids while Figs. 7 and 8 depict what the Examiner is analogizing to Applicants' main support grids it should be clear that the intermediate grids, or auxiliary grids have a longer axial length than the main support grids, which is contrary to Applicants' limitation. In col. 5 starting at line 15 of Thomazet et al., the reference, in discussing the auxiliary grids states " to increase further the rigidity of the grid, at least some of the plates are extended advantageously by a protruding portion 37 having a longitudinal stiffening fold 38", which reinforces the observation noted from the drawings.

Thomazet et al. is clearly directed at reducing the pitch between the upper spacer grids on a fuel assembly to promote flow mixing so as to reduce cladding corrosion. There is no mention of using intermediate grids between the main structural grids. There is also no mention of using the variable pitch of the main structural grids to prevent baffle jet induced fuel rod fretting. In fact, the tighter pitch would have to be employed further down in the fuel assembly to perform that function which would compromise the intent of enhancing flow mixing in the upper portion of the fuel assembly to reduce corrosion.

Accordingly, Applicants Claim 15 distinguishes over the teachings of Thomazet et al. for several of the limitations that it introduces. Though it is believed that Claim 15, as previously presented, makes it clear that the main support grids, that the auxiliary grid is sandwiched between, are part of the plurality of evenly spaced main support grids, Applicants have amended Claim 15 to specifically state that the auxiliary grid is sandwiched between two of the plurality of main support grids. Therefore, withdrawal of the rejection of Claim 15 set forth in Section 8 of the Office Action is respectfully requested.

In Section 9 of the Office Action Claims 1 – 5, 7, 9, 14 and 15 are rejected under 35 U.S.C. §102 (b) as being anticipated by Canat et al. (U.S. 5,183,629). In support of this rejection

the Examiner stated that the plurality of main support grids reads on grids 24 and at least one auxiliary grid reads on any one of the grids 26. The Examiner asserts in support of this rejection that the grids 26 have greater total contact area between springs/dimples and the fuel than the main support grid 24. In this regard the Examiner relies on Fig. 2 and col. lines 50+ to support the statement regarding the auxiliary grid, verses Fig. 8 and col. 5, lines 21+ to support the above statement with regard to the main support grid.

It is almost impossible to draw any conclusion of the relative size of the contact areas from the figures and the cited section in col. 4, starting at line 50, in support of the auxiliary grid statement, provides:

> To prevent the fuel rods 36 from coming into contact with the mixing fins 32 (only a few fuel rods are shown in Fig. 2), abutment bosses 38 are provided on the plates 28 and 30 and project into each of the cells occupied by a fuel rod 36. They project relative to the remainder of the plate by an amount small enough to leave diametrical clearance enabling the fuel rods 36 to slide freely. The bosses 38 may be aligned on a line that is offset relative to the middle of the cell face so as to avoid interfering with the roots of the mixing fins 32.

The reference in col. 4, starting at line 25 further states:

> The assembly of the invention shown in Fig. 1 also includes additional grids 26 for mixing the streams of coolant and for making temperature more uniform, i.e., grids that have a thermohydraulic function only [emphasis added]. These grids are generally placed solely in the hottest portions of the assembly, i.e., between the downstream structural grids. The assembly shown in Fig. 1 has three mixing grids 26, none of which has a belt and all of which perform a thermohydraulic function only [emphasis added], each mixing grid being placed in a gap between two structural grids 24.

Thus, it should be clear that the bosses on the grids 26 of Canat et al. do not structurally support the fuel elements, but are merely intended as a bumper to prevent the fuel rods from damaging the vanes in the event the fuel rods bow or vibrate during operation. In contrast, Applicants specification makes it clear that the auxiliary grids of Applicants are structural grids

that provide more support than the main support grids in the critical area of jetting along the mid third length of the fuel elements. In col. 5, starting at line 34 the Canat et al. specification states "in a modified embodiment, the bosses fitted to the grids 24 serve only to limit bending of the rods and prevent them from coming into contact with the fins in the event of the rods vibrating." Every indication in the specification of Canat et al. is that the bosses within the mixing grids 26 need only be large enough to perform their intended function of a backstop to prevent vibrating or bowing rods from damaging the vanes and do not function to support the rods. Furthermore, the grids 26 of Canat et al., which the Examiner analogizes to Applicant's auxiliary grids do not have an outer strap and thus completely lack any support in the outer cells to overcome baffle-induced cross-flow. Thus each fuel element support cell of Canat et al. does not support a fuel element. Accordingly, it is respectfully asserted that the teachings of Canat et al. fail to meet the structural limitations of Applicants Claim 1.

Claims 2 – 5, 7, 9 and 14 are either directly or indirectly dependent upon Claim 1 and distinguish for the foregoing reasons. Claim 15 similarly calls for the second set of dimples and/or springs on the auxiliary support cells to have a larger contact area with the fuel elements than the first set of dimples and/or springs on the walls of the main support cells, with each of the first and second fuel element support assemblies respectively comprising a first and second set of dimples and/or springs that continuously contact and support the fuel elements. Accordingly, Claim 15 distinguishes over the teachings of Canat et al. for the foregoing reasons.

In Section 10 of the Office Action Claims 1 – 5, 7, 9, 14 and 15 are rejected under 35 U.S.C. §102 (b) as being anticipated by Anthony (U.S. 4,058,436). The Examiner asserts in support of his rejection that Applicants' language "with each support cell supporting a single fuel element" does not preclude a support cell from supporting more than one fuel element as disclosed by the grid 18 in Anthony. Applicants respectfully disagree, but because Applicants firmly believe that the current language can only provide for the support of single a fuel element within a cell, Applicants have modified the language in Claims 1 and 15 to read: "with each support cell supporting only a single fuel element". Accordingly, the rejection in Section 10 of the Office Action should now be overcome. In addition, Applicants believe that Claim 5 further distinguish over Anthony for the individual limitation that it introduces. Claim 5 calls for the fuel assembly of Claim 3 wherein the auxiliary grids are positioned along the mid span of the fuel elements within the mid third region. Claim 3 calls for the fuel assembly of Claim 2

including a plurality of auxiliary grids positioned between some, but not all of the main support grids. Claim 2 calls for the fuel assembly of Claim 1 wherein the auxiliary gird is supported substantially midway between two main support grids. The language quoted by the Examiner in col. 4 of Anthony starting at line 48 states "if a single seismic grid 18 is employed it will be located as shown intermediate the ends of the fuel assembly. It may, in some circumstances, be desirable to employ a pair of additional seismic grids 18 positioned equidistant between the seismic grid of Fig.1 and the opposite ends of the fuel assembly." If the additional seismic grids are employed as called for in Anthony then the two additional grids would be outside the mid third region of the fuel element and outside the teachings of Claim 5. Accordingly, Claim 5 further distinguishes for the individual limitation that it introduces.

With regard to Claim 9 the Examiner noted from Fig. 6 that the top dimples 54 of the auxiliary grid 18 lie on the same horizontal plane and that the lower dimples lie on the same horizontal plane. Alternatively both top and bottom dimples lie on the same vertical plane of the wall to which they are attached. Claim 9 has been further clarified to state that the dimples and/or springs are co-planner along the same horizontal plane. Accordingly, Claim 9 further distinguishes over Anthony for the individual limitation that it introduces. The remaining claims are either directly or indirectly dependent upon Claim 1 and distinguish for the foregoing reasons. Therefore, it is respectfully requested that the rejection set forth in Section 10 of the Office Action be withdrawn.

In Section 11 of the Office Action Claim 10 is rejected under 35 U.S.C. §103 (a) as being unpatentable over Anthony (U.S. 4,058,436) in view of Leclerq (U.S. 4,844,861). In support of this rejection the Examiner asserted that:

> Applicant traverse the use of Leclerq to modify Anthony on the ground that Leclerq teaches employing fins on the median grids, which "teaches away from applicant's invention, which does not employ mixing vanes on the auxiliary grids in the mid-third region of the core." The Examine disagrees. The teaching in Leclerq to modify Anthony is on providing support grids (e.g., grid 20) with mixing vanes to increase turbulence of the coolant and improve heat transfer from the fuel to the cooling fluid, and not on the alleged use of mixing vanes for a grid at a specific location on the fuel element.

Anthony teaches in col. 7 starting at line 20 that:

> Referring now to Figs. 5 and 6, the seismic grid 18 is preferably comprised of stainless steel and is designed for optimum strength with minimum material. Stainless steel is a highly parasitic material . . .

The reference goes on to state at the very top of col. 8, line 1 that:

> The seismic grid or grids, as may be clearly seen from Fig. 5, do not replace a standard zicaloy spacer grid and do not support the fuel rods.

Continuing in col. 8 at line 16 the reference states:

> Also in the interest of reducing the amount of steel, and additionally in the interest of enhancing coolant flow and imposing minimum resistance to such flow, the perimeter strip 50 is provided with "windows".

Still further in col. 8 starting at line 27 the reference states:

> Dimples 54, which permit the reduction of the width of strip 50, also serve to limit the motion of the individual fuel rods 14 and thus are equivalent to the dimples 38 of the spacer grid of Fig. 3. As noted above, dimples 54 are normally not in contact with the fuel rods 14.

Thus, according to the teachings of Anthony the seismic grids 18 should have as little metal as possible and are not intended to support the fuel rods. The median grids 20 of Leclerq are positioned in the longitudinal mid-third region of the fuel assembly. The reference in col. 4 starting at line 46 states that the "median grids 20 may have the general construction shown in Figs. 5 and 6." The reference further states that the grids may be positioned with and used in a conventional fuel assembly except that they don't provide axial support for the fuel elements, "since the grids shown in Figs. 5 and 6 is without resilient holding springs." The reference goes on to state at line 52 of col. 4 that:

> The first function of grids 20 is to protect the fissile material element bundle against lateral shocks which assembly 10 may undergo. These grids 20 must in

> particular withstand, without transverse crushing shocks of seismic origin or accidental during operation or handling. Grids 20 must have a thickness and a height such that there cannot be a deformation of the grid narrowing the hydraulic passages to such an extent that the temperature of the sheath of the elements reaches a dangerous value. There must be no deformation either of the guide tubes or of their lattice hindering the movement of the elements belonging to the clusters.
>
> For this reason, the plates 24 of grids 20 will generally be thicker and wider than the plates of grids 18.
>
> The second function of the grids 20 is to introduce turbulences into the flow of the cooling fluid flowing upwardly through the cells such as 30. For that purpose, the plates may be provided with slanting fins 40.

Thus, the teaching of Leclerq fail to cure a number of the deficiencies noted for Anthony and merely teach that it is known to employ mixing vanes on some grids to create turbulence to enhance heat transfer between the fuel element cladding `and the coolant. However, Claim 10 teaches that at least some of the main support grids have mixing vanes and at least some of the auxiliary grids do not have mixing vanes. Providing the teaching of a reference that teaches placing the mixing vanes in grids other than the ones specified in Claim 10 should not rightfully render the claim obvious. Accordingly, Claim 10 distinguishes for the individual limitation that it introduces in addition to those pointed out for Claim 1 from which it depends.

Thus, Applicants have shown where Applicants' Claims 1-5, 7, 9-12, 14 and 15 patentably distinguish over the references considered either singly or in combination and satisfy the formal requirements of the patent laws. Accordingly reconsideration, allowance and passage to issue of this application are respectfully requested.

Respectfully submitted,

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